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various stages which exist in the lower animals, so have the activities of man also had a history. The germs of his doings are to be found, perhaps all of them, among the lower animals. The social instinct, the home-building instinct, the instinct to care for the young, and how many others do we find in the lower animals. That these activities of the lower animals have given rise to those of man there seems little room to doubt. Just as the structure of man must be viewed against a background formed of the structures of lower animals, in order that it may be understood, so must man's activities be viewed against the background formed of the activities of lower animals.

Zoologists are only slowly coming to realize this fact, and in the study of variation and its causes, in the study of the relation between the animal and its environment, in the study of ecology, or experimental zoology, we see evidence of this realization.

In this movement, indeed, the popular interest and the popular wisdom find their justification. In so far as zoology affords an explanation of the origin of human activities, it becomes important in the conduct of life, in so far it justifies itself in the eyes of the people. Zoology is now passing rapidly out of the ultra morphological and ultra systematic phase, into a phase where it will concern itself more with the activities of living animals and with the relation of these to the environment.

In these matters it will again appeal to the popular interest. Students from our colleges and universities when they have quitted the laboratory will no longer feel themselves strangers to nature. When they go among the people they will stimulate the study of a rational natural history.

From this cause and from the final lapse of the now nearly extinct opposition of the church we may expect a popular revival of interest in natural history subjects. In-

deed, the introduction of nature study into our schools, the increasing number of popular books and magazine articles on natural history indicate that this revival is already at hand.

In the days before Darwin natural history societies contributed no inconsiderable part to the advancement of the sciences of zoology and botany. This they did through their collections and through the discovery by their members of new species, new localities and hitherto unknown habits of animals. May not the revival of popular interest which seems to be at hand again contribute to the advance of zoology? Observations on the daily life of animals, on their distribution and variations, on related subjects, may be made without the elaborate equipment of laboratory and library that is necessary for morphological work. Such observations are well possible to isolated members of a society like this one, and carefully made and well thought out, become real contributions to our science.

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THE STEAM-TURBINE.

AN apparently important, and to the writer, at least, new, fact in the operation of the steam-turbine is revealed by experimental investigations in progress for some time past in the laboratories of Sibley College, with both saturated and superheated steam. Contrary to the usual theory of that apparatus, it is found that a very substantial gain may be had by the use of superheat, not only in efficiency but also in *capacity*.

The steam-turbine is not subject to that form of waste known as 'initial' or 'cylinder' condensation which adheres to every piston-engine as a consequence of the large fluctuations of temperature which accompany the variations within the cylinder be-

tween boiler and condenser pressures, and which, with the best of engines employing saturated steam, amount to ten or twenty per cent. and to a multiple of such figures for small machines. The interior surfaces of the turbine, in steady working, remain at precisely the same temperatures and absolutely without those fluctuations which produce waste in the reciprocating, and in the other forms of rotary, engine. As it is to reduce this particular waste that superheating is employed, ordinarily, there would not be expected to be found any other gain by its use in the steam-turbine than that increase of thermodynamic efficiency which is due to the widened range of temperature, in this case amounting to about one-tenth of one per cent. per degree of superheat. Investigations by Messrs. Schieren and Thomas, above alluded to, show, on the contrary, a gain of about one per cent. for each one and two-thirds degrees, C., three Fahrenheit degrees, of superheat and the remarkable and unexpected result of an increase in the capacity of the machine of about one hundred per cent. by the use of but 20° C., 37° Fahr., superheat. The 'water-rate' of the turbine, a La Val machine of ten horsepower as rated, decreased from about 21.7 kgs., 48 lbs., to 1.99 kgs., 44 lbs, with pressure rising from three atmospheres to eight, with a two-thirds vacuum, and with saturated steam; while the figures fell off about 12 per cent. with superheating, rising to a very moderate maximum as above. Reduced to thermal units per horse-power per hour, the same effect appears in a very similar proportion. The causes of the gain in thermodynamic efficiency and of capacity are presumably identical—the extinction of the friction-wastes due to the retardation of the current of fluid traversing the passages of the turbine by concurrent resistances coming of the weighting of the current of steam with drops and mist and the adherence of moisture in mist, drops and even

streams, very probably, to the walls of the steam-passages of the turbine. The phenomenon will however, be the subject of extended investigation in the course of the work in research constantly in progress and a way will probably be found of precisely identifying the cause and determining the laws governing its action in the production of these variations of efficiency and capacity. That this apparently obvious explanation is the correct one and, certainly, that the gain is not due any such action as produces the remarkably beneficial effects observed in the reciprocating engine, is tolerably well indicated by the fact that the gain in this case, by superheating, is substantially proportional, so far as here carried, to the amount of superheat and the graphic log shows a straight line of decreasing consumption of steam.

R. H. THURSTON.

THE MORINGUOID EELS IN AMERICAN WATERS.

NOTWITHSTANDING the numerous eels which have been discovered in American waters, none has yet been found which has been referred to the family of *Moringuidæ*. Indeed, from the literature it would appear that the group was peculiar to the seas of India and the Molucca-Indian archipelago. However, Dr. Smith recently received from Mr. George M. Gray, of Woods Hole, an eel found in branching coral at San Geronimo, near San Juan, on the north shore of the island of Porto Rico, which he was at a loss to allocate and took it to Dr. Gill. The latter was struck by its resemblance to *Aphthaimichthys*, and the subsequent comparison with the figures of Bleeker's 'Atlas Ichthyologiques des Indes Orientales Néerlandaises' revealed no differential characters to separate it from that genus. Further, a consideration of the very elongated whip-like forms referred by Jordan and Evermann